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VII

The 100 Ma. Kearsley Stabilizer

THE Kearsley stabilizer was invented by William Kearsley, of the General Electric Company's Research Laboratories at Schenectady, New York, in 1920.

The principal parts used in the construction of the Kearsley stabilizer are as follows:

1. The main relay consists of an armature and two coils.

The main relay automatically cuts resistance in and out of the filament circuit, and is operated by the coils or magnets which are actuated by the high tension. These coils or magnets may be placed at variable distances from the armature, depending upon the amount of current to be used through the tube.

This magnet pull is downward. The upward movement is controlled by a spring with a definite tension. The further away the coils are from the armature, the greater the amount of milliamperage necessary to overcome this spring tension, hence the greater amount of current through the tube, and vice versa.

2. Resistance, controlled by the main relay.

This resistance is in series with the filament of the tube and is cut in or out of circuit by the armature of the main relay, the circuit being so arranged that, when the milliamperage tends to increase, this resistance is instantaneously put in circuit by the main relay, thereby reducing the filament current and the milliamperage. On the other hand a tendency to reduce the milliamperage cuts the resistance out of the circuit and increases the milliamperage. This action takes place many times per second and the resistance is in or out a sufficient portion of the time so as to maintain an average filament current of sufficient value to give a desirable milliamperage.

3. "Surge" relay, consisting of armature and one coil.

In order that the stabilizer may have a range of 2 to 100 ma., it was necessary to devise a means whereby with the use of the low milliamperages it would not be necessary to make changes in the Coolidge regulator setting. It is necessary to have available at all times sufficient amperage to deliver 100 ma. through the tube. If no surge relay were used, each time the X-ray switch is closed a surge through the tube would result. The surge relay allows

also for a much wider range of ampere variation with no change of current through the tube.

4. Resistance, controlled by the "surge" relay.

Resistance is also in series in the filament circuit. When the switch is closed for the higher milliamperages, this resistance is cut out of the circuit and remains out until the X-ray switch is opened. The resistance is variable to take care of long overhead runs, variation in tube filament resistance or low filament transformer voltage.

5. Condenser.

High frequency surges from a gassy tube or other causes are by-passed around the main and surge relay coils to protect them.

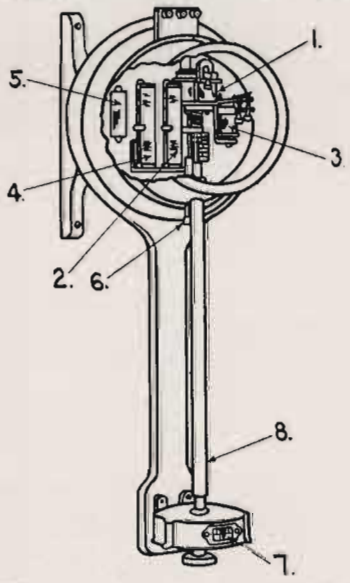
6. Cut-out switch.

When this switch is pushed up, the stabilizer is completely out of the circuit and the milliamperage is controlled by means of the Coolidge regulator.

7. Stabilizer scale.

This scale is calibrated from 2 to 100, and may be placed for any desired milliamperage. It is connected by the insulated rod to the vibrating relay coils or magnets and, when varied, changes the distance between the coils and vibrating relay.

8. Insulated connection rod to the scale.



(1) Main relay consisting of armature and two coils.

(2) Resistance controlled by the main relay.

(3) "Surge" relay consisting of armature and one coil.

(4) Resistance controlled by the "surge" relay.

(5) Condenser.

(6) Cut-out switch.

(7) Stabilizer scale.

(8) Insulated connection rod to the scale.

The stabilizer being in the high tension side, the scale must be insulated from the stabilizer in order that the milliamperage may be varied with the X-ray switch on.

This scale is arbitrary and should be set at the figure which previous calibration has shown to represent the definite milliamperage desired.

Function of the Stabilizer

The function of the stabilizer is to maintain a constant current value (ma.) through the tube, regardless of either filament current variations or kilovolts peak variation, within operating limits. A variation of 1 per cent in filament amperes would result in a 20 per cent change in milliamperage if a stabilizer were not used.

The stabilizer operates from 2 to 100 ma.

The 100 ma. stabilizer is connected in the secondary circuits of the step-up and filament transformers. It does not regulate or stabilize the main line voltage. Even though the filament current were constant the stabilizer eliminates tube testing, keeps the milliamperage constant regardless of the auto-transformer or rheostat button used, and takes care of the normal drop in milliamperage (in radiator tubes particularly) which occurs as the tube heats up.

The stabilizer is operated by the tube current and changes the filament current by an amount sufficient to offset changes in line voltage and tube filament resistance. After the proper stabilizer scale figure has been found, all that is necessary is to place it at the same figure each time.

The same stabilizer setting will in general deliver the same milliamperage in any Coolidge tube. Due to a slight variation in filament resistance, however, it may be well to follow the directions furnished with the stabilizer when various tubes are used.

The 100 ma. stabilizer does not operate on self-rectifying units (another type of stabilizer is constructed for such units). It operates with equal efficiency on both auto-transformer and rheostat-controlled mechanically rectified units. It will not increase the milliamperage output of any machine. If the machine has an output of less than 100 ma. the stabilizer, when set at maximum, will deliver only the maximum current output of the machine.

It increases tube life by eliminating the necessity of testing the tube.

QUESTIONS AND ANSWERS PERTAINING TO THE 100 MA. KEARSLEY STABILIZER

1. *What does the name Kearsley signify in relation to the Kearsley stablizer?*

   Ans.—William Kearsley, of the General Electric Comany's Research Laboratories at Schenectady, is the inventor of the stabilizer.

2. *What are the principal parts used in the construction of the Kearsley stabilizer?*

   Ans.—Main relay, consisting of armature and two coils.
   Resistance, controlled by the main relay.
   "Surge" relay, consisting of armature and one coil.
   Resistance, controlled by the "Surge" relay.
   Condenser.
   Cut-out switch.

Stabilizer scale.
Insulated connection rod in the scale.

3. *What is the function of the main relay?*

Ans.—The main relay automatically cuts resistance in and out of the filament circuit, and is operated by the coils or magnets which are actuated by the high tension. These coils or magnets may be placed at variable distances from the armature, depending upon the amount of current to be used through the tube. This magnetic pull is downward. The upward movement is controlled by a spring with a definite tension. The farther away the coils are from the armature, the greater the amount of milliamperage necessary to overcome this spring tension, hence the greater amount of current through the tube, and vice versa.

4. *What is the purpose of the resistance controlled by the main relay?*

Ans.—This resistance is in series with the filament of the tube and is cut in or out of circuit by the armature of the main relay, the circuit being so arranged that, when the milliamperage tends to increase, this resistance is instantaneously put in circuit by the main relay, thereby reducing the filament current and the milliamperage on the other hand. A tendency to reduce the milliamperage cuts the resistance out of the circuit and increases the milliamperage. This action takes place many times per second and the resistance is in or out a sufficient portion of the time so as to maintain an average filament current of sufficient value to give a desirable milliamperage.

5. *What is the function of the surge relay armature?*

Ans.—In order that the stabilizer have a range of 2 to 100 ma. it was necessary to devise a means whereby, with the use of the low milliamperages, it would not be necessary to make changes in the Coolidge regulator setting. It is necessary to have available at all times sufficient amperage to deliver 100 ma. through the tube. If no surge relay were used, each time the X-ray switch is closed a surge through the tube would result. The surge relay allows also for a much wider range of ampere variations with no change of current through the tube.

6. *What is the purpose of the surge relay resistance?*

Ans.—This resistance is also in series in the filament circuit. When the switch is closed for the higher milliamperages, this resistance is cut out of the circuit and remains out until the X-ray switch is opened. The resistance is variable to take care of long overhead runs, variation in tube filament resistance, low filament transformer voltage, etc.

7. *What is the purpose of the condenser?*

Ans.—High frequency surges from a gassy tube or other causes are bypassed around the main and surge relay coils to protect them.

8. *What is the purpose of the cut-out switch?*

Ans.—When this switch is pushed up, the stabilizer is completely out of the circuit and the milliamperage is controlled by means of the Coolidge regulator.

9. *What is the purpose of the stabilizer scale?*

Ans.—This scale is calibrated from 2 to 100 and may be placed for any desired milliamperage. It is connected by the insulated rod to the vibrating relay coils or magnets, and, when varied, changes the distance between the coils and vibrating relay.

10. *What is the purpose of the insulated connection rod?*

Ans.—The stabilizer being in the high tension side, the scale must be insulated from the stabilizer in order that the milliamperage may be varied with the X-ray switch on.

11. *Does the scale on the stabilizer signify milliamperes?*

Ans.—Not necessarily. This scale is arbitrary and should be set at the figure which previous calibration has shown to represent the definite milliamperage desired.

12. *What is the function of the Kearsley stabilizer?*

Ans.—To maintain a constant current value (ma.) through the tube, regardless of either filament current variations of kilovolts peak variation, within operating limits.

13. *Is the ratio of change between amperes and milliamperes the same?*

Ans.—No. A 1 per cent variation in filament amperes causes approximately a 20 per cent change in milliamperes.

14. *Is the stabilizer used for all phases of radiographic work?*

Ans.—Yes. Except for milliamperages above 100.

15. *Is the stabilizer in the primary or secondary circuit?*

Ans.—The 100 ma. model of stabilizer here discussed is entirely in the secondary circuit of the step-up and filament transformers. Other designs are connected slightly different.

16. *Does the stabilizer keep the main line voltage constant?*

Ans.—No.

17. *Does the stabilizer have any value if the filament current is constant?*

Ans.—Yes, as it eliminates tube testing, keeps the milliamperage constant, regardless of the auto-transformer or rheostat button used, and takes care of the normal drop in milliamperage (in radiator tubes particularly), which occurs as the tube heats up.

18. *How is this accomplished?*

Ans.—Operated by the tube current itself, the Kearsley stabilizer changes the filament current by an amount sufficient to offset changes in line voltage and tube vacuum.

19. *Is it necessary to test the tube each time to get the desired milliamperage?*

Ans.—No. After the proper stabilizer scale figure has been found all that is necessary is to place it at the same figure each time.

20. *Will the stabilizer setting have to be changed to get the same milliamperage on various tubes?*

Ans.—No. The same stabilizer setting will in general deliver the same milliamperage in any Coolidge tube. Due to a slight variation in filament resistance, however, it may be well to follow the directions furnished with the stabilizer when various tubes are used.

21. *Will the stabilizer operate on self-rectifying units?*

Ans.—Yes. A stabilizer of different design but incorporating the same principles may be used.

22. *Will the stabilizer operate on both auto-transformer and rheostat-controlled machines?*

Ans.—Yes. The stabilizer should operate with equal efficiency on both.

23. *Will the stabilizer increase the milliamperage output of a machine?*

Ans.—No. If the machine has an output of less than 100 ma. the stablizer, when set at maximum, will deliver only the maximum current output of the machine.

24. *What effect does the stabilizer have upon tube life?*

Ans.—As it eliminates the necessity of testing the tube, the life of the tube is increased.